Module Catalogue
for the Subject
Biochemistry
as a Master’s with 1 major
with the degree "Master of Science"
(120 ECTS credits)

Examination regulations version: 2017
Responsible: Faculty of Medicine
Responsible: Faculty of Chemistry and Pharmacy
## Contents

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Module Catalogue for the Subject Biochemistry
Master's with 1 major, 120 ECTS credits

Compulsory Electives 2

Focus Expert Key Qualifications (practice oriented)

Subfield Research oriented Projects

Practical course - abroad 1
Practical course - abroad 2
Practical course - external 1
Practical course - external 2
Practical lab course 1
Practical lab course 2
Practical lab course 3
Practical lab course 4
Practical lab course 5
Practical lab course 6
Scientific lecturing M2
Assistance in practical courses 2

Subfield Completive Qualifications

Bioorganic Chemistry
Bioanorganic Chemistry
Modern aspects of natural product Chemistry and Biological Chemistry
Organo- and Biocatalysis
Bioinformatics
Systems Biology
Methods in Life Sciences
Animal science and welfare
Scientific lecturing M1
Assistance in practical courses 1
Literature seminar 3

Focus - Expert Key Qualifications

Subfield Research oriented Projects

Practical course - abroad 1
Practical course - abroad 2
Practical course - external 1
Practical course - external 2
Practical lab course 1
Practical lab course 2
Practical lab course 3
Practical lab course 4
Practical lab course 5
Practical lab course 6
Scientific lecturing M2
Assistance in practical courses 2

Subfield Completive Qualifications

Bioorganic Chemistry
Bioanorganic Chemistry
Modern aspects of natural product Chemistry and Biological Chemistry
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Content and Objectives of the Programme

The Faculty of Chemistry and Pharmacy and the Faculty of Medicine of the JMU offer the study program "Biochemistry" with the degree "Master of Science" (acquisition of 120 ECTS credits) as part of a consecutive Bachelor and Master program. The study program is assigned to the profile type "rather research-oriented". The degree "Master of Science" is further qualifying for a vocational or research-oriented career. The qualification acquired during the Master degree program corresponds to that of a Diploma in Biochemistry (University).

The biochemistry study program prepares for a scientific profession in the field of biochemistry and for an academic career in a Ph.D. program. The aim of the training is to provide students with in-depth knowledge of scientific practice in research and application of biochemistry and its fundamental principles. By educating and training of analytical thinking, the student acquires the ability to familiarize himself/herself later on with the manifold tasks assigned to him/her and, in particular, to independently apply the basic knowledge acquired in the consecutive bachelor's and master's degree program and transfer it to new problems.

Through the final thesis, the students show their capability to deal with a biochemical problem in a thematically and temporally limited extent, especially by applying known methods or by modifying the same, from a scientific point of view. The Master’s exam ascertains that the candidate has a good understanding of the correlations in biochemistry and the ability to apply the acquired scientific methodology independently. It leads to the acquisition of an internationally comparable degree in the field of biochemistry and represents a further vocational or research-oriented degree.

The successfully completed Master exam entitles the graduate to commence a doctoral degree program in accordance with the relevant doctoral degree program regulations of the JMU in their valid versions.
Abbreviations used

Course types: E = field trip, K = colloquium, O = conversatorium, P = placement/lab course, R = project, S = seminar, T = tutorial, Ü = exercise, V = lecture

Term: SS = summer semester, WS = winter semester

Methods of grading: NUM = numerical grade, B/NB = (not) successfully completed

Regulations: (L)ASPO = general academic and examination regulations (for teaching-degree programmes), FSB = subject-specific provisions, SFB = list of modules

Other: A = thesis, LV = course(s), PL = assessment(s), TN = participants, VL = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2015

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

05-Jul-2017 (2017-43)
24-Mar-2020 (2020-25)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.
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(50 ECTS credits)
Focus - Molecular Life-Sciences
(50 ECTS credits)
Subfield - Structural and Functional Biochemistry
(30 ECTS credits)
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**Contents**

The module imparts detailed and in-depth the current state of science in the field of research on RNA-protein complexes, their structure and function, as well as the theoretical basics of current RNA-based research methods.

**Intended learning outcomes**

After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)
Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Life cycle of proteins | 08-MBC-LCP-152-m01

Module coordinator | Module offered by
holder of the Chair of Biochemistry | Chair of Biochemistry

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Contents
The module imparts detailed and in-depth the current state of science in the field of research on the regulation and control of the entire life cycle of proteins.

Intended learning outcomes
After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + S (1)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
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Students will be informed about the method, length and scope of the assessment prior to the course.
Language of assessment: German and/or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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**Module coordinator**

holder of the Chair of Biochemistry

**Module offered by**

Chair of Biochemistry

**ECTS**

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**Duration**

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<tr>
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**Contents**

The module allows a deeper incorporation into the research methods and techniques in the field of investigation of RNA-protein complexes in a practical course.

**Intended learning outcomes**

After completing the module, the student masters the techniques used in the practical course. He/She is able to explain and to critically reflect the performed experiments, and to both present and discuss the results in a written report.

**Courses**

(type, number of weekly contact hours, language — if other than German)

| Ü (6) Module taught in: German or English |

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)

Assessment offered: Once a year, winter semester

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

The module allows a deeper incorporation into the research methods and techniques in the field of protein degradation in eukaryotes in a practical course.

**Intended learning outcomes**

After completing the module, the student masters the techniques used in the practical course. He/She is able to explain and to critically reflect the performed experiments, and to both present and discuss the results in a written report.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (6)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)

Assessment offered: Once a year, summer semester

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title: Macromolecular Crystallography
Abbreviation: 08-MBC-MK-152-m01

Module coordinator: holder of the Chair of Biochemistry
Module offered by: Chair of Biochemistry

ECTS: 10
Method of grading: numerical grade
Duration: 1 semester
Module level: graduate
Other prerequisites: --

Contents
The module "Macromolecular Crystallography" consists of lectures, exercises and a practical course. The lecture series covers the following topics: Biophysical characterization of protein samples prior to crystallization; crystallization by various techniques, either by manual or high throughput operation; properties and production of X-rays and their production by means of X-ray generators and synchrotron sources; data collection with various detector systems; symmetry properties of molecules, point groups and space groups; description of the phase problem and solving this problem by means of multiple isomorphous replacement, anomalous diffraction and molecular replacement; improving experimentally determined phases by solvent flattening and molecular averaging; manual and automatic model building; refinement procedures and analysis of experimentally determined structures. In the exercises the topics covered in the lectures will be recapitulated with the help of problem sets.
In the practical course, the students will carry out all steps discussed in the lecture series, which are necessary for the determination of a protein structure using lysozyme as an example; starting with the crystallization of the purified protein, data collection using the in-house diffractometer, the solution of the phase problem on the basis of the anomalous signal of the intrinsic sulfur atoms, model building, structure refinement and, finally, the analysis of the refined structure.

Intended learning outcomes
Participants will acquire extensive knowledge in modern macromolecular crystallographic methods. The basics of the method are presented in great depth in the lectures, the intellectually most demanding aspects are reiterated in the exercises and the practical approach will be explained in detail in the practical course. Participants are thus put in a position to be able to take on a crystallographic structure analysis as part of their master's or PhD studies.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (1) + P (5)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Assessment offered: Once a year, summer semester
Language of assessment: German and/or English

Allocation of places
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
--
### Module title

**Mass-Spectrometry and Proteomics**

### Abbreviation

08-MBC-MSP-152-m01

### Module coordinator

holder of the Chair of Biochemistry

### Module offered by

Chair of Biochemistry

### ECTS

5

### Method of grading

Only after succ. compl. of module(s)

### Duration

1 semester

### Other prerequisites

graduate

### Contents

The module "Mass Spectrometry and Proteomics" includes a lecture, which teaches the basics of mass spectrometry of biomolecules. There, inter alia, the gentle ionization ESI and MALDI, and the functional principles of different mass analyzers such as TOF and Orbitrap are discussed. The lecture part gives an introduction to the mass spectrometric fragmentation techniques CID and ETD, i.e., separation techniques for peptides and proteins, as well as to the analysis of mass spectrometric data (protein databases, FDR, GO terms, etc.). Furthermore, an overview of the field of quantitative proteomics is given; especially different methods of quantification by stable isotopes (SILAC, N15-Labeling, iTRAQ, etc.) will be discussed. Finally, the lecture gives insights in the mass spectrometric analysis of posttranslational modifications. The seminar part of the module imparts fundamentals of mass spectrometric analysis. To this end, the participants will be introduced to different software packages and then work independently on exemplary data sets to find solutions for different tasks. In the practical part of the module, participants will isolate a protein complex from yeast by affinity purification. This complex is separated by 1D-SDS-PAGE and proteolytically cleaved in the gel. The peptides obtained are analyzed by nanoLC-MS / MS. Finally data analysis is conducted with the aim of identifying specific interaction partners and post-translational modifications.

### Intended learning outcomes

On a broad basis, participants are taught the theoretical foundations of mass spectrometric analysis of proteins and proteomes. In the seminar, participants learn how to use data analysis software in the field of proteomics. In the practical part, students will learn affinity purification of a protein complex, and typical steps of sample preparation for mass spectrometric protein analysis, such as SDS-PAGE and in-gel digestion. Participants get an insight into the operation of a nanoHPLC-coupled mass spectrometer.

### Courses

(type, number of weekly contact hours, language — if other than German)

V (2) + S (1) + P (2)

Module taught in: German or English

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Assessment offered: Once a year, winter semester

Language of assessment: German and/or English

### Allocation of places

Biochemie (Biochemistry), Master’s: 6 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

### Additional information

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Drug design | 08-MCM3-152-m01

Module coordinator | Module offered by
Pharmazeutische Chemie (Pharmaceutical Chemistry) | Institute of Pharmacy and Food Chemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
5 | numerical grade | --

Duration | Module level | Other prerequisites
1 semester | graduate | --

Contents
Fundamentals: drug targets (types and classification), target validation, effect mechanisms, protein-ligand interactions, lead finding; lead optimisation. Experimental methods: bioassays, HTS, combinatorial chemistry, naturally occurring substances. Theoretical methods: molecular modelling, structure-based drug design, pharmacophore models, docking, virtual screening, simulation methods, de novo design. Ligand-based drug design. QSAR. Predictions of pharmacokinetic and toxicological components (ADME). Case examples, prodrug strategies, bioisosterism, SAR.

Intended learning outcomes
The student masters theoretical and experimental methods and aspects of drug design.

Courses
<table>
<thead>
<tr>
<th>type, number of weekly contact hours, language — if other than German</th>
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</table>
S (2) + Ü (1) |
Module taught in: German or English

Method of assessment | type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus |
|---|
presentation with discussion (approx. 30 minutes) |
Language of assessment: German and/or English

Allocation of places
20 places. 4 places for students of the Master's degree programme Chemie (Chemistry): Places will be allocated according to the same number of subject semesters; students who have chosen Medizinische Chemie (Medicinal Chemistry) as their focus will be given preferential consideration; among applicants with the same number of subject semesters, places will be allocated by lot.; 6 places for students of the Master’s degree programme Biochemie (Biochemistry): Places will be allocated according to the number of subject semesters; among applicants with the same number of subject semesters, places will be allocated by lot; a waiting list will be maintained and places re-allocated by lot as they become available.

Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<table>
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<td>Faculty of Medicine</td>
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### ECTS
- **5**

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### Duration
- **1 semester**

<table>
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<tr>
<th>Module level</th>
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<tr>
<td>graduate</td>
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### Contents
The module "Protein Biophysics" will provide participants with detailed insights into the biophysical characterization of proteins. We will deal both with soluble model proteins (Dr. Sonja Lorenz) and with the particular challenges of membrane protein research (Dr. Sebastian Geibel). The module contains a lecture part that deals with the basics of different biophysical methods to characterize protein stability, oligomerization behavior and shape. Among others, small angle X-ray scattering (SAXS), circular dichroism (CD) spectroscopy, fluorimetry (DSC) and light scattering (DLS + MALS) are discussed. The lectures will be complemented by short presentations on selected topics. In the practical part of the course, the techniques discussed will be applied using self-isolated proteins, data will be analysed with computer support and interpreted scientifically.

### Intended learning outcomes
The participants get an overview of the manifold biophysical methods for characterizing proteins and the particularities of working with membrane proteins. The acquired knowledge ranges from the theoretical basics of the methods to their practical application to the scientific analysis and interpretation of the data and should give a realistic impression of the researcher's life.

### Courses
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<th>Type</th>
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<td>English</td>
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### Method of assessment
- a) written examination (approx. 45 to 90 minutes) or
- b) log (20 to 30 pages) or
- c) oral examination of one candidate each (20 to 30 minutes) or
- d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or
- e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

### Allocation of places
Biochemie (Biochemistry) Master's: 63 places.

### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
Electron microscopy and Image processing in structural biology

Abbreviation: 08-MBC-EMV-172-m01

Module coordinator: holder of the Chair of Biochemistry

Module offered by: Chair of Biochemistry

ECTS: 5

Method of grading: numerical grade

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents

The module "Electron Microscopy and Image Processing in Structural Biology" contains a lecture part which explains the basics of electron microscopy and image processing. First, the components of the electron microscope, beam path, image formation and contrast transmission are explained. Subsequently, different methods of sample preparation for electron microscopy in structural biology will be discussed as well as strategies for instrument alignment and data acquisition. The second part of the lecture concentrates on the processing of image data. The focus is on the principles of single image analysis. This includes the alignment of image data, their classification and three-dimensional image reconstruction. DeNovo and iterative methods of 3D image reconstruction are discussed. The learned principles are then applied to the special cases of 2D crystal analysis and tomography. Finally, micro electron diffraction is presented as an alternative to X-ray structure analysis. In the seminar part of the module some aspects of the lecture are deepened on the basis of case studies from the literature. The students will read these case studies in advance. In this work they are guided through a catalogue of questions. Some of the questions will be addressed independently in a written homework in advance. Most case studies will be presented by one student each. All case studies will be explained in a discussion. The participants develop a critical understanding of the advantages and limitations of the method. Some selected topics will be further deepened by arithmetic exercises.

Intended learning outcomes

The participants will learn the theoretical basics of electron microscopy and image processing in structural biology on a broad basis. They will get an overview of key strategies of the method, which are essential for structure elucidation. These can be applied and deepened in a practical course. In the end, all participants will be able to understand, communicate and critically evaluate primary literature on this method.

Courses

(type, number of weekly contact hours, language — if other than German)

V (1) + S (1)
Module taught in: German or English

Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

--
**Module title**
Practical course of electron microscopy and image processing

**Abbreviation**
o8-MBC-EMP-172-m01

**Module coordinator**
holder of the Chair of Biochemistry

**Module offered by**
Chair of Biochemistry

**ECTS**
10

**Method of grading**
numerical grade

**Only after succ. compl. of module(s)**
--

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
--

**Contents**
The module "Practical Course Electron Microscopy and Single Image Processing" consists of an electron microscopy part and an image processing part. In the electron microscopy part the participants get to know the different elements of the electron microscope and how they work. Aspects of alignment, focusing and data acquisition will be developed. The participants will then use different preparation methods for electron microscopy (grid preparation, negative contrast and vitrification). The samples are then imaged in an electron microscope. Sample and data optimization are developed and data sets are created for further image processing. In the image processing part, the participants are first introduced to general aspects of computer operation under Linux (basic Linux commands, basic shell scripting). On this basis, the participants determine the structure of a protein complex from a real test data set. They learn step by step how to select good images, how to correct data for image-dependent aberrations and how to normalize, mask and filter image data. With the data prepared in this way, the participants will determine the characteristic views of the complex (2D classification) and combine these with various methods to form a DeNovo model. This model is then refined in an iterative process. In the second part of the image processing practical course the participants apply what they have learned to their own data. At the end of the practical course the participants present the different working steps and exchange experiences. The practical part of the electron microscopy practical course and the image processing practical course on test data will be summarized in a protocol. The results on the own data are presented in the form of a scientific publication, which requires a corresponding literature work and the creation of more complex images.

**Intended learning outcomes**
The participants will be taught the skills to prepare an already purified biological complex for structure determination with the help of electron microscopy and to independently determine its structure de novo from electron microscopic data. The participants will acquire a practical understanding for the data acquisition at the electron microscope and will be able to plan and carry out a corresponding experiment with technical support in the future. The participants will further develop the following key qualifications in the course: Computer skills (insights into Linux), team skills (working in teams of 2-3 students with varying composition), communication skills (oral and written presentation of results).

**Courses**
(type, number of weekly contact hours, language — if other than German)
P (8)
Module taught in: German or English

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)
Assessment offered: Once a year, summer semester
Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
### Contents

This lecture provides a broad overview of biophysical techniques and their applications. The first part of the lecture discusses fundamental aspects of thermodynamics, kinetics and molecular interactions. The course then moves on to discuss biophysical methods that facilitate the investigation of individual cells down to the level of single molecules. Focus is on electromanipulation and dielectric spectroscopy of cells, biomembranes, electrophysiology, ion channels, protein folding, single-molecule fluorescence methods and high-resolution as well as dynamic microscopy.

### Intended learning outcomes

Students will have acquired a knowledge of fundamental biophysical methods and their applications that will enable them to independently review relevant literature. In addition, they will have become acquainted with - or, where necessary, will be able to independently acquaint themselves with - biophysical mechanisms.

### Courses

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<th>Type</th>
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<tr>
<td>V</td>
<td>2</td>
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Module taught in: English

### Method of assessment

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English
### Module title

| Literature seminar 1 | 08-MBC-LIT1-152-m01 |

### Module coordinator

| Chairperson of examination committee Biochemie (Biochemistry) |
| Chair of Biochemistry |

### ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | -- |

### Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | graduate | -- |

### Contents

Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

### Intended learning outcomes

The students train their abilities in reading and critical questioning current literature of the life sciences with relation to the biochemistry. They improve their skills in presenting and arguing of scientific contents.

### Courses

| S (2) |
| Module taught in: German or English |

### Method of assessment

| presentation (20 to 40 minutes) |
| Language of assessment: German and/or English |

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
--- | ---
Single Cell Biology | 03-98-SCB-192-m01

Module coordinator | Module offered by
holder of the Chair of Molecular Infection Biology I | Chair of Molecular Infection Biology

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<th>Only after succ. compl. of module(s)</th>
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<td>numerical grade</td>
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Duration | Module level | Other prerequisites
1 semester | graduate | --

Contents

The Single Cell Biology course is at the interface of genomics, bioinformatics, biology and pathology. It will give an introduction of the most recent technologies for single cell analysis and an overview of the application of single cell biology across the medical field (cancer, immunology, cardiovascular diseases, and infectious diseases). Practical components will allow the students to be familiarized with the basic tools to perform data analysis.

Intended learning outcomes

Students are familiar with fundamental concepts of single cell biology throughout the life sciences and they can apply basic procedures to analyze single cell data sets.

Courses (type, number of weekly contact hours, language — if other than German)

V (1,5) + Ü (0,5)
Module taught in: Englisch

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 60 minutes)
Language of assessment: English
creditable for bonus

Allocation of places

M.Sc.Biomed: 156
M.Sc. Biochem: 156
M.Sc. Biowis: 106

Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Subfield - Molecular and Medical Cell Biology
(20 ECTS credits)
<table>
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<td>Human genetics</td>
<td>03-MS2HG-152-m01</td>
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<th>Module offered by</th>
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<tbody>
<tr>
<td>holder of the Chair of of Human Genetics</td>
<td>Faculty of Medicine</td>
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<tbody>
<tr>
<td>2 semester</td>
<td>graduate</td>
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</table>

### Contents

This module will discuss current topics in human genetics.

### Intended learning outcomes

Students have developed the ability to understand relevant questions in human genetics and to discuss these in detail.

### Courses

(type, number of weekly contact hours, language — if other than German)

V (2) + S (2)

Module taught in: German or English

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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<table>
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<tr>
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<td>Clinical-analytical Chemistry</td>
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<tbody>
<tr>
<td>lecturer of lecture &quot;Klinisch-analytische Chemie&quot; (Clinical and Analytical Chemistry)</td>
<td>Institute of Pharmacy and Food Chemistry</td>
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<tr>
<th>Duration</th>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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**Contents**

This module covers specific topics of clinical analytical chemistry.

**Intended learning outcomes**

Students have developed an advanced knowledge of molecular biology.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (3)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 120 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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**Contents**

This module covers practical topics in clinical chemistry and clinical diagnostics as well as the related analytical methods.

**Intended learning outcomes**

Students have developed a knowledge of clinical analytical chemistry and are able to apply it to practical experiments.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (5)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Module title: Microbiology 1

Module coordinator: holder of the Chair of Microbiology

Module offered by: Faculty of Biology

ECTS: 10

Method of grading: numerical grade

Only after succ. compl. of module(s)

Duration: 1 semester

Module level: graduate

Other prerequisites: --

Contents:
Fundamentals of molecular microbiology and infection biology, mechanisms of adherence and invasion, bacterial pathogenicity factors, regulation of virulence, mechanisms of host defence and pathogen interference, current methods in infection biology.

Intended learning outcomes:
The students are able to understand fundamental theories of molecular microbiology and infection biology, emergence of infectious diseases.

Courses:

(type, number of weekly contact hours, language — if other than German)

V (2) + S (1)

Method of assessment:
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

Allocation of places:
Biochemie (Biochemistry), Master's: 15 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

Additional information:

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Referred to in LPO I:
(examination regulations for teaching-degree programmes)
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<td>Faculty of Biology</td>
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<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>--</td>
</tr>
</tbody>
</table>

**Contents**

Fundamental principles of the mode of action of microbial pathogenicity factors will be presented using selected prokaryotic and eukaryotic pathogens as model organisms. In addition, current research methods in infection biology will be presented.

**Intended learning outcomes**

Students have gained fundamental knowledge in infection biology and pathogenicity research and the mechanisms behind infectious diseases.

**Courses** (type, number of weekly contact hours, language — if other than German)

| V (2) | S (1) |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- a) written examination (approx. 45 to 90 minutes) or
- b) oral examination of one candidate each (20 to 30 minutes) or
- c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master’s: 15 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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</thead>
<tbody>
<tr>
<td>Infection Biology for Biochemistry Students</td>
<td>07-MS2INF-BC-191-m01</td>
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</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>holder of the Chair of Microbiology</td>
<td>Faculty of Biology</td>
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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>5</td>
<td>Only after succ. compl. of module(s)</td>
<td>May not be combined with 07-MS2M1.</td>
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</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Fundamentals of molecular microbiology and infection biology, mechanisms of adherence and invasion, bacterial pathogenicity factors, regulation of virulence, mechanisms of host defence and pathogen interference, current methods in infection biology.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intended learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The students are able to understand fundamental theories of molecular microbiology and infection biology, emergence of infectious diseases.</td>
</tr>
</tbody>
</table>

| Courses (type, number of weekly contact hours, language — if other than German) |
|---------------------------------|---------------------------------|
| V (2)                            | Module taught in: German and/or English |

<table>
<thead>
<tr>
<th>Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) written examination (approx. 45 to 90 minutes) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes per candidate)</td>
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<tr>
<th>Language of assessment: German and/or English</th>
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<table>
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<tr>
<th>Allocation of places</th>
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<tr>
<th>Additional information</th>
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<table>
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<tr>
<th>Referred to in LPO I (examination regulations for teaching-degree programmes)</th>
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</thead>
</table>

| Master’s with 1 major Biochemistry (2017) | JMU Würzburg • generated 08-Aug-2022 • exam. reg. data record Master (120 ECTS) Biochemie - 2017 | page 30 / 154 |
# Pathogenicity of Microorganisms for Biochemistry Students

**Module title**
Pathogenicity of Microorganisms for Biochemistry Students

**Abbreviation**
07-MS2PA-BC-191-m01

**Module coordinator**
holder of the Chair of Microbiology

**Module offered by**
Faculty of Biology

**ECTS**
5

**Method of grading**
numerical grade

**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
May not be combined with 07-MS2M2.

**Contents**
Fundamental principles of the mode of action of microbial pathogenicity factors will be presented using selected prokaryotic and eukaryotic pathogens as model organisms. In addition, current research methods in infection biology will be presented.

**Intended learning outcomes**
Students have gained fundamental knowledge in infection biology and pathogenicity research and the mechanisms behind infectious diseases.

**Courses**
(type, number of weekly contact hours, language — if other than German)

- V (2)

Module taught in: German and/or English

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- a) written examination or c) oral examination of one candidate each or d) oral examination in groups of up to 3 candidates. Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (approx. 30 to 60 minutes, also multiple choice) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Immunology 1 | 03-MS2IM1-152-m01

Module coordinator
holder of the Professorship of Immunogenetics

Module offered by
Faculty of Medicine

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
10 | numerical grade | --

Duration | Module level | Other prerequisites
---|---|---
1 semester | graduate | --

Contents
Familiarity with the fundamentals of molecular and cellular immunology that allow a deeper understanding of immune-mediated defence mechanisms. This incorporates common literature readings, presentations and tests on selected immunology book chapters and recent original literature in English language.

Intended learning outcomes
Students will gain a knowledge of fundamental concepts and methods in molecular and cellular immunology and will be able to present and discuss these.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + S (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Assessment offered: Once a year, winter semester
Language of assessment: German and/or English

Allocation of places
Biochemie (Biochemistry), Master's: 3 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Immunology 2</td>
<td>03-MS2IM2-152-m01</td>
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<tbody>
<tr>
<td>holder of the Professorship of Immunogenetics</td>
<td>Faculty of Medicine</td>
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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

**Contents**

Recent progress in molecular and cellular immunology. Deeper insights into selected immunology chapters, such as autoimmunity and immune modulation, development of the immune system, immunogenetics, evolution, infection immunology, and more. This incorporates common literature readings, presentations and tests on selected immunology book chapters and recent original literature.

**Intended learning outcomes**

Students are able to understand current problems in immunology and to discuss these in detail.

**Courses**

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
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<tr>
<td>V (1) + S (2)</td>
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Module taught in: English

**Method of assessment**

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<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus</th>
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</thead>
<tbody>
<tr>
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</table>

Assessment offered: Once a year, summer semester

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master's: 3 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Virology 1</td>
<td>03-MS2V1-152-m01</td>
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<table>
<thead>
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<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>holder of the Chair of Virology</td>
<td>Faculty of Medicine</td>
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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

**Contents**

This module will discuss contemporary topics in virology.

**Intended learning outcomes**

Students are able to understand current problems in virology and to discuss these in detail.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (1) + S (2)

Module taught in: English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Assessment offered: Once a year, winter semester

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master's: 3 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO 1**

(examination regulations for teaching-degree programmes)

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<th>Abbreviation</th>
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<tbody>
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<td>03-MS2V2-152-m01</td>
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<table>
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<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>holder of the Chair of Virology</td>
<td>Faculty of Medicine</td>
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<tr>
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<th>Module level</th>
<th>Other prerequisites</th>
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</tbody>
</table>

**Contents**

This module will discuss contemporary topics in virology.

**Intended learning outcomes**

Students are able to understand current problems in virology and to discuss these in detail.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (2)

Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Assessment offered: Once a year, summer semester

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master's: 3 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

--

**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

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# Module Catalogue for the Subject Biochemistry

## Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial genetics - Infectiology</td>
<td>03-98-PBG-152-m01</td>
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<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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</thead>
<tbody>
<tr>
<td>Institute of Molecular Infection Biology</td>
<td>Faculty of Medicine</td>
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<tbody>
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<table>
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<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</tbody>
</table>

## Contents

Foundations and analytical approaches of bacterial genetics are taught based on selected questions from molecular microbiology. Genetic processes are analysed with the help of examples of gene transfer. Molecular genetic and functional biochemical pathways are presented using examples from microbiology.

## Intended learning outcomes

Students have developed the ability to approach, analyse and interpret general problems in bacterial genetics based on individually assigned tasks, using techniques of modern molecular biology, microbiology and genetics. They also have developed skills in experimental design, bench work, data analysis and the presentation of scientific results both orally and in writing.

## Courses

*(type, number of weekly contact hours, language — if other than German)*

<table>
<thead>
<tr>
<th>V (1)</th>
<th>S (1)</th>
<th>Ü (4)</th>
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</table>

## Method of assessment

*(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)*

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

## Allocation of places

Biochemie (Biochemistry), Master's: 4 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

## Additional information

--

## Referred to in LPO I

*(examination regulations for teaching-degree programmes)*

--
Module title | Abbreviation
---|---
Cardiovascular Biology | 03-98-MVKB-152-m01

Module coordinator | Module offered by
holder of the Chair of Experimental Biomedicine | Faculty of Medicine

ECTS | Method of grading | Only after succ. compl. of module(s)
5 | numerical grade | --

Duration | Module level | Other prerequisites
1 semester | graduate | --

Contents
Becoming familiar with the basics of the cardiovascular system by means of a lecture series. The first section comprises the anatomical, physiological and bio-chemical basis. In the second section these fundamentals will be deepened based on relevant cardiovascular diseases of platelets, the vasculature and the heart. In the context of these disorders, current and future targets for adequate therapies will be discussed.

Intended learning outcomes
Students have developed the ability to understand the molecular and physiological basics relevant for cardiovascular biology, with the focus on developmental biology, platelets and coagulation. These will be exemplified by stroke, myocardial disorders, metabolic syndrome, vasculitides and genetic causes. After attending the lecture series, students will be able to understand, describe and assign pathological and pathophysiological changes affecting the cardiovascular system.

Courses
(type, number of weekly contact hours, language — if other than German)
V (2)
Module taught in: German/English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).
Students will be informed about the method, length and scope of the assessment prior to the course.
Assessment offered: Once a year, winter semester
Language of assessment: German or English

Allocation of places
--

Additional information
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Referred to in LPO I
( examination regulations for teaching-degree programmes)
--
### Module title
Molecular Oncology

### Abbreviation
03-98-MVMO-152-m01

### Module coordinator
holder of the Chair of Biochemistry and Molecular Biology

### ECTS
5

### Method of grading
Only after succ. compl. of module(s)

### Duration
1 semester

### Module level
graduate

### Contents
Molecular mechanisms of tumourigenesis; experimental dissection of tumours; metabolic reprogramming in cancer; visualising in vivo tumour progression and response to therapy; targeting Myc for tumour therapy; Wnt signalling and colorectal cancer; cell cycle and tumour suppressor genes; protein turnover in normal and cancer cells; molecular mechanisms of melanoma development; tumour immunology; stem cells and epigenetics; signal transduction and personalised cancer therapy; molecular pathology; infections and tumour development.

### Intended learning outcomes
Students understand the current topics and challenges in tumour research and the methods used to address such challenges.

### Courses
(type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: German/English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Once a year, winter semester

Language of assessment: German or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Clinical Oncology</td>
<td>03-ONC-CLIN-152-m01</td>
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<table>
<thead>
<tr>
<th>Module coordinator</th>
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</thead>
<tbody>
<tr>
<td>holder of the Chair of Translational Oncology</td>
<td>Faculty of Medicine</td>
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<tr>
<th>Duration</th>
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<th>Other prerequisites</th>
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<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

**Contents**

In the module "Klinische Onkologie" ("Clinical Oncology"), various clinicians will present a current view of the disease "cancer". Topics will include an overview of different tumour entities (including cancers of the blood, skin, breast, lung, liver, colon, endocrine system), treatment modalities (e.g. immunotherapy, radiation-based therapy, personalised medicine), diagnostics, pathology, clinical studies.

**Intended learning outcomes**

An understanding of the biological commonalities and particularities of different tumour types. An understanding of the needs, possibilities and limitations of clinical approaches.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Module title

<table>
<thead>
<tr>
<th>Stem Cell Biology</th>
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</table>

### Abbreviation

03-98-MVSZ-152-m01

### Module coordinator

Institute of Medical Radiology and Cell Research (MSZ)

### Module offered by

Faculty of Medicine

### ECTS

5

### Method of grading

numerical grade

### Only after succ. compl. of module(s)

--

### Duration

1 semester

### Module level

graduate

### Other prerequisites

--

### Contents

In this module, selected current problems from the fields of stem cell biology, cellular differentiation and regenerative medicine are used to provide basic knowledge as well as analytical approaches. The current state of research is considered on the basis of the historical context. Selected examples are used to learn about topic-specific contexts. Special emphasis is placed on the methodology used to study and characterize stem cells at the molecular level in vivo and in vitro. Bio-ethical and legal frameworks are discussed in the course of the lecture.

### Intended learning outcomes

Necessary basic knowledge to work on, analyze and critically interpret questions from stem cell biology, cellular differentiation and regenerative medicine on the basis of current literature. A basic methodological competence for independent scientific work in the field of stem cell biology. Development of an ethical awareness in relation to the application of stem cells in biomedicine.

### Courses

(type, number of weekly contact hours, language — if other than German)

<table>
<thead>
<tr>
<th>V (2)</th>
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<tbody>
<tr>
<td>Module taught in: German/English</td>
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### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course. Assessment offered: Once a year, summer semester

Language of assessment: German or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
--- | ---
Clinical Neurobiology | 03-98-MVKN-152-m01

Module coordinator | Module offered by
holder of the Chair of Clinical Neurobiology | Faculty of Medicine

| ECTS | Method of grading | Only after succ. compl. of module(s) |
--- | --- | ---
5 | numerical grade | -- |

Duration | Module level | Other prerequisites
1 semester | graduate | -- |

Contents
Students will get a theoretical introduction to neurobiology and clinical neurobiology. The following topics will be discussed: introduction to neurons and glia, ion channels and membrane potential, ion channelopathies, synapses, transmitter release, NMJ, myasthenia gravis, cerebellum, basal ganglia, ataxia and Morbus Parkinson, somatosensory system, touch, pain, schizophrenia and autism spectrum disorders, disorders of cognition, muscle and muscle diseases, anatomy and function of the motor system, spinal reflexes, motoneuron diseases, hippocampus, learning and memory, anterograde amnesia, visual agnosia, cortex and the limbic system, emotions, disorders of conscious and unconscious mental processes, attention, smell and taste and hearing, sleep, EEG, epilepsy, vision and diseases of the visual system. The literature seminars are based on fundamental literature on lecture-relevant topics to document the experiments underlying our present knowledge in neurobiology.

Intended learning outcomes
Students who successfully completed this module will have acquired insights into current theoretical concepts in neurobiology. They will have examined clinical aspects of neurobiology with a focus on the molecular, cellular and physiological mechanisms. Additionally, they will have learned how to evaluate and present data in oral form. The students will have learned to critically read scientific publications in the field of neurobiology and will have been trained in the ability to extract relevant information from the original literature.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + S (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or d) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Tissue Engineering / Functional Materials</td>
<td>03-98-MVT-152-m01</td>
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<tbody>
<tr>
<td>holder of the Chair of Tissue Engineering (University Hospital)</td>
<td>Faculty of Medicine</td>
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<td>1 semester</td>
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**Contents**

Cell culture techniques, fundamentals of tissue engineering, test systems as an alternative to animal experiments in skin, intestine, lung, trachea, kidney, blood-brain barrier, tumours and other diseases, development of cell-based transplants, regulatory fundamentals for approval of medical products and drugs. These are REACH (registration, evaluation, restriction and approval of drugs), medicine products law, GLP (good lab practice), GMP (good manufacturing practice), GCP (good clinical practice).

**Intended learning outcomes**

The student has expertise in tissue engineering, regenerative medicine, bioprocess engineering, test systems and basic relationships in the field of cell biology, metabolism, differentiation, adhesion to surfaces and mechanobiology. The student has methodological competence in quality management. The contents taught in the course lead to a deeper understanding of these competence fields and enable the application, which allows an independent assessment by analyzing publications or questions. For this purpose, the student should be able to understand a scientific publication in this field, to acquire additional background knowledge independently and, after analyzing the experimental results, to evaluate and discuss them critically.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course. Assessment offered: Once a year, winter semester

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<td>Literature seminar 2</td>
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<td>chairperson of examination committee Biochemie (Biochemistry)</td>
<td>Chair of Biochemistry</td>
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### Contents

Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

### Intended learning outcomes

The students train their abilities in reading and critical questioning current literature of the life sciences with relation to the biochemistry. They improve their skills in presenting and arguing of scientific contents.

### Courses (type, number of weekly contact hours, language — if other than German)

S (2)

Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation (20 to 40 minutes)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO (examination regulations for teaching-degree programmes)

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<td>Tumor Genetics</td>
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<tr>
<td>holder of the Professorship Human Genetics at Institute for Human Genetics</td>
<td>Institute of Human Genetics</td>
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**Contents**

Basics on human genetics (inheritance patterns, mutation types, etc.), hereditary cancer (breast & ovarian cancer, HNPCC, FAP, etc.), cancer syndromes, tumor cytogenetics, epigenetics in cancer, animal models in cancer genetics, genetic techniques (NGS, genome engineering, etc.)

**Intended learning outcomes**

The students have acquired broad knowledge in the field of tumor genetics and hereditary tumor diseases as well as specific knowledge about genetic methods. They are able to apply this acquired knowledge to scientific questions in tumor genetics. Students can independently develop scientific texts, discuss them critically and present them.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)

Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Focus - Molecular Oncology
(50 ECTS credits)
Subfield - Tumor Biology
(35 ECTS credits)
Module title: Molecular Oncology
Abbreviation: 03-98-MVMO-152-m01
Module coordinator: holder of the Chair of Biochemistry and Molecular Biology
ECTS: 5
Method of grading: numerical grade
Duration: 1 semester
Module level: graduate
Other prerequisites: --

Contents
Molecular mechanisms of tumourigenesis; experimental dissection of tumours; metabolic reprogramming in cancer; visualising in vivo tumour progression and response to therapy; targeting Myc for tumour therapy; Wnt signalling and colorectal cancer; cell cycle and tumour suppressor genes; protein turnover in normal and cancer cells; molecular mechanisms of melanoma development; tumour immunology; stem cells and epigenetics; signal transduction and personalised cancer therapy; molecular pathology; infections and tumour development.

Intended learning outcomes
Students understand the current topics and challenges in tumour research and the methods used to address such challenges.

Courses
(type, number of weekly contact hours, language — if other than German)
V (2)
Module taught in: German/English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).
Students will be informed about the method, length and scope of the assessment prior to the course.
Assessment offered: Once a year, winter semester
Language of assessment: German or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<td>Clinical Oncology</td>
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**Module coordinator**
holder of the Chair of Translational Oncology

**Module offered by**
Faculty of Medicine

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**Duration**
1 semester

**Module level**
graduate

**Other prerequisites**
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**Contents**

In the module "Klinische Onkologie" ("Clinical Oncology"), various clinicians will present a current view of the disease "cancer". Topics will include an overview of different tumour entities (including cancers of the blood, skin, breast, lung, liver, colon, endocrine system), treatment modalities (e.g. immunotherapy, radiation-based therapy, personalised medicine), diagnostics, pathology, clinical studies.

**Intended learning outcomes**

An understanding of the biological commonalities and particularities of different tumour types. An understanding of the needs, possibilities and limitations of clinical approaches.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**
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**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
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**Contents**

In the module "Seminar in Onkologie" ("Oncology Seminar 1"), selected original publications in cancer research are read and critically discussed. Participants are strongly advised to concurrently attend the lecture "Molecular Oncology" (03-ONC-MOLO).

**Intended learning outcomes**

Critical reading and understanding of primary literature in molecular biology and cancer research.

**Courses**

(type, number of weekly contact hours, language — if other than German)

S (1)

Module taught in: German or English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 45 to 90 minutes) or presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master’s: 18 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<td>Oncology Seminar 2</td>
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<tr>
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<td>Faculty of Medicine</td>
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**Contents**

In the module "Seminare in Onkologie 2" ("Oncology Seminar 2"), selected original publications in cancer research are read and critically discussed. Participants are strongly advised to concurrently attend the lecture "Clinical Oncology" (03-ONC-CLIN).

**Intended learning outcomes**

Critical reading and understanding of primary literature in molecular biology and cancer research.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 45 to 90 minutes) or presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

Biochemie (Biochemistry), Master’s: 18 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title
Experimental Tumor Biology

Abbreviation
03-ONC-TUMP-152-m01

Module coordinator
holder of the Chair of Biochemistry and Molecular Biology

Module offered by

ECTS
10

Method of grading
numerical grade

Only after succ. compl. of module(s)
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Duration
1 semester

Module level
graduate

Other prerequisites
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Contents
In the practical course "Tumorbiologie-Praktikum" ("Experimental Tumour Biology"), students learn about various model systems (tissue culture and animal models) and experimental approaches in cancer research (e.g. flow cytometry, tissue staining & microscopy, quantitative expression analysis, metabolic analyses). Prior (or concurrent) attendance of the lecture "Molekulare Onkologie" ("Molecular Oncology") and the course "Seminars in Onkologie" ("Seminars in Oncology") 1 or 2 is required.

Intended learning outcomes
Knowledge of selected tumour models and techniques for experimental tumour research. Ability to read and understand relevant primary literature.

Courses
(type, number of weekly contact hours, language — if other than German)
P (8)
Module taught in: German or English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
Log (20 to 30 pages) or presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places
Biochemie (Biochemistry), Master’s: 18 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

Additional information

Referred to in LPO I
(examination regulations for teaching-degree programmes)

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<td>1 semester</td>
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**Contents**

Under the guidance of experienced scientists, students will work on an ongoing project in cancer research in a research laboratory.

**Intended learning outcomes**

Hands-on experience with experimental cancer research.

**Courses** (type, number of weekly contact hours, language — if other than German)

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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

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<th>Log (20 to 30 pages) or presentation (20 to 40 minutes)</th>
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**Allocation of places**

Biochemie (Biochemistry), Master's: 18 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Subfield - Structural and Functional Biochemistry
(15 ECTS credits)
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<td>RNA worlds</td>
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**Module coordinator**  
holder of the Chair of Biochemistry  
Chair of Biochemistry

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**Contents**

The module imparts detailed and in-depth the current state of science in the field of research on RNA-protein complexes, their structure and function, as well as the theoretical basics of current RNA-based research methods.

**Intended learning outcomes**

After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)  
Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
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<th>Contents</th>
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<tbody>
<tr>
<td>The module imparts detailed and in-depth the current state of science in the field of research on the regulation and control of the entire life cycle of proteins.</td>
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<table>
<thead>
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<th>Intended learning outcomes</th>
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<td>After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.</td>
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<td>V (1) + S (1)</td>
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| Module taught in: | |
|-------------------| |
| German or English  | |

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Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

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### Module title
Structure and function of RNA-protein complexes

### Abbreviation
08-MBC-RNP-152-m01

### Module coordinator
holder of the Chair of Biochemistry

### Module offered by
Chair of Biochemistry

### ECTS
10

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
The module allows a deeper incorporation into the research methods and techniques in the field of investigation of RNA-protein complexes in a practical course.

### Intended learning outcomes
After completing the module, the student masters the techniques used in the practical course. He/She is able to explain and to critically reflect the performed experiments, and to both present and discuss the results in a written report.

### Courses
(type, number of weekly contact hours, language — if other than German)

| Ü (6) |

Module taught in: German or English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)

Assessment offered: Once a year, winter semester
Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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**Contents**

The module allows a deeper incorporation into the research methods and techniques in the field of protein degradation in eukaryotes in a practical course.

**Intended learning outcomes**

After completing the module, the student masters the techniques used in the practical course. He/She is able to explain and to critically reflect the performed experiments, and to both present and discuss the results in a written report.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (6)
Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)
Assessment offered: Once a year, summer semester
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title

Macromolecular Crystallography

Abbreviation

08-MBC-MK-152-m01

Module coordinator

holder of the Chair of Biochemistry

Module offered by

Chair of Biochemistry

ECTS

10

Method of grading

Only after succ. compl. of module(s)

numerical grade

Duration

1 semester

Module level

graduate

Other prerequisites

--

Contents

The module "Macromolecular Crystallography" consists of lectures, exercises and a practical course. The lecture series covers the following topics: Biophysical characterization of protein samples prior to crystallization; crystallization by various techniques, either by manual or high throughput operation; properties and production of X-rays and their production by means of X-ray generators and synchrotron sources; data collection with various detector systems; symmetry properties of molecules, point groups and space groups; description of the phase problem and solving this problem by means of multiple isomorphous replacement, anomalous diffraction and molecular replacement; improving experimentally determined phases by solvent flattening and molecular averaging; manual and automatic model building; refinement procedures and analysis of experimentally determined structures. In the exercises the topics covered in the lectures will be recapitulated with the help of problem sets. In the practical course, the students will carry out all steps discussed in the lecture series, which are necessary for the determination of a protein structure using lysozyme as an example; starting with the crystallization of the purified protein, data collection using the in-house diffractometer, the solution of the phase problem on the basis of the anomalous signal of the intrinsic sulfur atoms, model building, structure refinement and, finally, the analysis of the refined structure.

Intended learning outcomes

Participants will acquire extensive knowledge in modern macromolecular crystallographic methods. The basics of the method are presented in great depth in the lectures, the intellectually most demanding aspects are reiterated in the exercises and the practical approach will be explained in detail in the practical course. Participants are thus put in a position to be able to take on a crystallographic structure analysis as part of their master’s or PhD studies.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (1) + P (5)

Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Assessment offered: Once a year, summer semester

Language of assessment: German and/or English

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
---|---
Mass-Spectrometry and Proteomics | 08-MBC-MSP-152-m01

Module coordinator | Module offered by
holder of the Chair of Biochemistry | Chair of Biochemistry

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Method of grading | Only after succ. compl. of module(s)

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Contents
The module "Mass Spectrometry and Proteomics" includes a lecture, which teaches the basics of mass spectrometry of biomolecules. There, inter alia, the gentle ionization ESI and MALDI, and the functional principles of different mass analyzers such as TOF and Orbitrap are discussed. The lecture part gives an introduction to the mass spectrometric fragmentation techniques CID and ETD, into separation techniques for peptides and proteins, as well as to the analysis of mass spectrometric data (protein databases, FDR, GO terms, etc.). Furthermore, an overview of the field of quantitative proteomics is given; especially different methods of quantification by stable isotopes (SILAC, N15-Labeling, iTRAQ, etc.) will be discussed. Finally, the lecture gives insights in the mass spectrometric analysis of posttranslational modifications. The seminar part of the module imparts fundamentals of mass spectrometric analysis data. To this end, the participants will be introduced to different software packages and then work independently on exemplary data sets to find solutions for different tasks. In the practical part of the module, participants will isolate a protein complex from yeast by affinity purification. This complex is separated by 1D-SDS-PAGE and proteolytically cleaved in the gel. The peptides obtained are analyzed by nanoLC-MS/MS. Finally, data analysis is conducted with the aim of identifying specific interaction partners and post-translational modifications.

Intended learning outcomes
On a broad basis, participants are taught the theoretical foundations of mass spectrometric analysis of proteins and proteomes. In the seminar, participants learn how to use data analysis software in the field of proteomics. In the practical part, students will learn affinity purification of a protein complex, and typical steps of sample preparation for mass spectrometric protein analysis, such as SDS-PAGE and in-gel digestion. Participants get an insight into the operation of a nanoHPLC-coupled mass spectrometer.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + S (1) + P (2)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Assessment offered: Once a year, winter semester
Language of assessment: German and/or English

Allocation of places
Biochemie (Biochemistry), Master’s: 6 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

Additional information

Referred to in LPO I (examination regulations for teaching-degree programmes)
Module title | Abbreviation
--- | ---
Drug design | 08-MCM3-152-m01

| Lecturers | Module offered by |
--- | --- |
Pharmazeutische Chemie (Pharmaceutical Chemistry) | Institute of Pharmacy and Food Chemistry |

| ECTS | Method of grading | Only after succ. compl. of module(s) |
--- | --- | --- |
5 | numerical grade | -- |

| Duration | Module level | Other prerequisites |
--- | --- | --- |
1 semester | graduate | -- |

**Contents**

Fundamentals: drug targets (types and classification), target validation, effect mechanisms, protein-ligand interactions, lead finding; lead optimisation. Experimental methods: bioassays, HTS, combinatorial chemistry, naturally occurring substances. Theoretical methods: molecular modelling, structure-based drug design, pharmacophore models, docking, virtual screening, simulation methods, de novo design. Ligand-based drug design. QSAR. Predictions of pharmacokinetic and toxicological components (ADME). Case examples, prodrug strategies, bioisosterism, SAR.

**Intended learning outcomes**

The student masters theoretical and experimental methods and aspects of drug design.

**Courses**

| Type, number of weekly contact hours, language — if other than German |
--- | --- |
S (2) + Ü (1) | |

Module taught in: German or English

**Method of assessment**

| Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus |
--- | --- |
presentation with discussion (approx. 30 minutes) | |
Language of assessment: German and/or English |

**Allocation of places**

20 places. 4 places for students of the Master’s degree programme Chemie (Chemistry): Places will be allocated according to the same number of subject semesters; students who have chosen Medizinische Chemie (Medicinal Chemistry) as their focus will be given preferential consideration; among applicants with the same number of subject semesters, places will be allocated by lot.; 6 places for students of the Master’s degree programme Biochemie (Biochemistry): Places will be allocated according to the number of subject semesters; among applicants with the same number of subject semesters, places will be allocated by lot; a waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
---|---
Biophysics of Proteins | 03-MBC-PBP-172-m01

Module coordinator | Module offered by
Chair of Rudolf Virchow Center for Experimental Biomedicine | Faculty of Medicine

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Contents

The module "Protein Biophysics" will provide participants with detailed insights into the biophysical characterization of proteins. We will deal both with soluble model proteins (Dr. Sonja Lorenz) and with the particular challenges of membrane protein research (Dr. Sebastian Geibel). The module contains a lecture part that deals with the basics of different biophysical methods to characterize protein stability, oligomerization behavior and shape. Among others, small angle X-ray scattering (SAXS), circular dichroism (CD) spectroscopy, fluorimetry (DSC) and light scattering (DLS + MALS) are discussed. The lectures will be complemented by short presentations on selected topics. In the practical part of the course, the techniques discussed will be applied using self-isolated proteins, data will be analysed with computer support and interpreted scientifically.

Intended learning outcomes

The participants get an overview of the manifold biophysical methods for characterizing proteins and the particularities of working with membrane proteins. The acquired knowledge ranges from the theoretical basics of the methods to their practical application to the scientific analysis and interpretation of the data and should give a realistic impression of the researcher's life.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + S (1) + P (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places

Biochemie (Biochemistry) Master's: 63 places.

Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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### Contents

The module "Electron Microscopy and Image Processing in Structural Biology" contains a lecture part which explains the basics of electron microscopy and image processing. First, the components of the electron microscope, beam path, image formation and contrast transmission are explained. Subsequently, different methods of sample preparation for electron microscopy in structural biology will be discussed as well as strategies for instrument alignment and data acquisition. The second part of the lecture concentrates on the processing of image data. The focus is on the principles of single image analysis. This includes the alignment of image data, their classification and three-dimensional image reconstruction. DeNovo and iterative methods of 3D image reconstruction are discussed. The learned principles are then applied to the special cases of 2D crystal analysis and tomography. Finally, micro electron diffraction is presented as an alternative to X-ray structure analysis. In the seminar part of the module some aspects of the lecture are deepened on the basis of case studies from the literature. The students will read these case studies in advance. In this work they are guided through a catalogue of questions. Some of the questions will be addressed independently in a written homework in advance. Most case studies will be presented by one student each. All case studies will be explained in a discussion. The participants develop a critical understanding of the advantages and limitations of the method. Some selected topics will be further deepened by arithmetic exercises.

### Intended learning outcomes

The participants will learn the theoretical basics of electron microscopy and image processing in structural biology on a broad basis. They will get an overview of key strategies of the method, which are essential for structure elucidation. These can be applied and deepened in a practical course. In the end, all participants will be able to understand, communicate and critically evaluate primary literature on this method.

### Courses

**Module taught in:** German or English

**V (1) + S (1)**

### Method of assessment

**Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus**

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

**Language of assessment:** German and/or English
Module title
Practical course of electron microscopy and image processing

Abbreviation
08-MBC-EMP-172-m01

Module coordinator
holder of the Chair of Biochemistry

Module offered by
Chair of Biochemistry

ECTS
10

Method of grading
numerical grade

Only after succ. compl. of module(s)
--

Duration
1 semester

Module level
graduate

Other prerequisites
--

Contents
The module "Practical Course Electron Microscopy and Single Image Processing" consists of an electron microscopy part and an image processing part. In the electron microscopy part the participants get to know the different elements of the electron microscope and how they work. Aspects of alignment, focusing and data acquisition will be developed. The participants will then use different preparation methods for electron microscopy (grid preparation, negative contrast and vitrification). The samples are then imaged in an electron microscope. Sample data and data optimization are developed and data sets are created for further image processing. In the image processing part, the participants are first introduced to general aspects of computer operation under Linux (basic Linux commands, basic shell scripting). On this basis, the participants determine the structure of a protein complex from a real test data set. They learn step by step how to select good images, how to correct data for image-dependent aberrations and how to normalize, mask and filter image data. With the data prepared in this way, the participants will determine the characteristic views of the complex (2D classification) and combine these with various methods to form a DeNovo model. This model is then refined in an iterative process. In the second part of the image processing practical course the participants apply what they have learned to their own data. At the end of the practical course the participants present the different working steps and exchange experiences.

The practical part of the electron microscopy practical course and the image processing practical course on test data will be summarized in a protocol. The results on the own data are presented in the form of a scientific publication, which requires a corresponding literature work and the creation of more complex images.

Intended learning outcomes
The participants will be taught the skills to prepare an already purified biological complex for structure determination with the help of electron microscopy and to independently determine its structure de novo from electron microscopic data. The participants will acquire a practical understanding for the data acquisition at the electron microscope and will be able to plan and carry out a corresponding experiment with technical support in the future. The participants will further develop the following key qualifications in the course: Computer skills (insights into Linux), team skills (working in teams of 2-3 students with varying composition), communication skills (oral and written presentation of results).

Courses
(type, number of weekly contact hours, language — if other than German)
P (8)
Module taught in: German or English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) log (20 to 30 pages) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or d) presentation (20 to 40 minutes)
Assessment offered: Once a year, summer semester
Language of assessment: German and/or English

Allocation of places
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Additional information
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Referred to in LPO l (examination regulations for teaching-degree programmes)
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Module title | Abbreviation
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Biophysics and Molecular Biotechnology | 07-MS2BT-152-m01

Module coordinator | Module offered by
holder of the Chair of Biotechnology and Biophysics | Faculty of Biology

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Duration | Module level | Other prerequisites
1 semester | graduate | --

Contents
This lecture provides a broad overview of biophysical techniques and their applications. The first part of the lecture discusses fundamental aspects of thermodynamics, kinetics and molecular interactions. The course then moves on to discuss biophysical methods that facilitate the investigation of individual cells down to the level of single molecules. Focus is on electromanipulation and dielectric spectroscopy of cells, biomembranes, electrophysiology, ion channels, protein folding, single-molecule fluorescence methods and high-resolution as well as dynamic microscopy.

Intended learning outcomes
Students will have acquired a knowledge of fundamental biophysical methods and their applications that will enable them to independently review relevant literature. In addition, they will have become acquainted with - or, where necessary, will be able to independently acquaint themselves with - biophysical mechanisms.

Courses
(type, number of weekly contact hours, language — if other than German)
V (2) + S (1)
Module taught in: English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)
Language of assessment: German and/or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module title: Literature seminar 1
Abbreviation: 08-MBC-LIT1-152-m01

Module coordinator: Chairperson of examination committee Biochemie (Biochemistry)
Module offered by: Chair of Biochemistry

ECTS: 5
Method of grading: Numerical grade
Only after success completion of module(s): --

Duration: 1 semester
Module level: Graduate
Other prerequisites: --

Contents:
Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode, each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

Intended learning outcomes:
The students train their abilities in reading and critical questioning current literature of the life sciences related to biochemistry. They improve their skills in presenting and arguing of scientific contents.

Courses:
(type, number of weekly contact hours, language — if other than German)
S (2)
Module taught in: German or English

Method of assessment:
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
Presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places:
--

Additional information:
--

Referred to in LPO I (examination regulations for teaching-degree programmes):
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## Module title

**Single Cell Biology**

### Abbreviation

03-98-SCB-192-m01

## Module coordinator

**Module offered by**

holder of the Chair of Molecular Infection Biology I  
Chair of Molecular Infection Biology

### ECTS

5

### Method of grading

Only after succ. compl. of module(s)

numerical grade --

### Duration

1 semester  
graduate --

### Other prerequisites

---

## Contents

The Single Cell Biology course is at the interface of genomics, bioinformatics, biology and pathology. It will give an introduction of the most recent technologies for single cell analysis and an overview of the application of single cell biology across the medical field (cancer, immunology, cardiovascular diseases, and infectious diseases). Practical components will allow the students to be familiarized with the basic tools to perform data analysis.

## Intended learning outcomes

Students are familiar with fundamental concepts of single cell biology throughout the life sciences and they can apply basic procedures to analyze single cell data sets.

## Courses

(type, number of weekly contact hours, language — if other than German)

V (1,5) + Ü (0,5)  
Module taught in: Englisch

## Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 60 minutes)  
Language of assessment: English  
creditable for bonus

## Allocation of places

M.Sc.Biomed: 156  
M.Sc. Biochem: 156  
M.Sc. Biowis: 106

## Additional information

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## Referred to in LPO I

(examination regulations for teaching-degree programmes)

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Compulsory Electives 2

(40 ECTS credits)
Focus Expert Key Qualifications (practice oriented)
(40 ECTS credits)
Subfield Research oriented Projects

(30 ECTS credits)
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### Contents

The internship is carried out at universities abroad and can be embedded within offered study programs (e.g., Erasmus). The content requirements should comply with those of the electives of the Biochemistry Master program at the University of Würzburg (what has to be ascertained in advance under discussion with the module coordinator).

### Intended learning outcomes

The students are familiar with working methods at universities abroad. Besides professional competences they have also acquired language and social skills.

### Courses

No courses assigned to module

### Method of assessment

- a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)
- Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO 1

(examination regulations for teaching-degree programmes)

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## Module title

| Practical course - abroad 2 | 08-MBC-AP2-152-m01 |

## Module coordinator

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## Module offered by

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## ECTS

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## Contents

The internship is carried out at universities abroad and can be embedded within offered study programs (e.g., Erasmus). The content requirements should comply with those of the electives of the Biochemistry Master program at the University of Würzburg (what has to be ascertained in advance under discussion with the module coordinator).

## Intended learning outcomes

The students are familiar with working methods at universities abroad. Besides professional competences they have also acquired language and social skills.

## Courses

No courses assigned to module

## Method of assessment

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Language of assessment: German or English

## Allocation of places

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## Additional information

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## Referred to in LPO 1

(examination regulations for teaching-degree programmes)

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Module title: Practical course - external 1
Abbreviation: 08-MBC-EP1-152-m01

Module coordinator: Chairperson of examination committee Biochemie (Biochemistry)
Module offered by: Chair of Biochemistry

ECTS: 15
Method of grading: Only after succ. compl. of module(s)

Duration: (not) successfully completed
Module level: graduate
Other prerequisites: --

Contents:
The internship is carried out in a non-university research / diagnostic institution or in a company. The contents of the internship will be determined by the institution. The content requirements shall correspond to an internship offered in the study program of the Biochemistry Master program at the University of Würzburg, what has to be defined in advance in consultation with the module coordinator.

Intended learning outcomes:
Students are acquainted with the structures of non-university institutions and possess specific professional skills.

Courses (type, number of weekly contact hours, language — if other than German):
No courses assigned to module

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus):
a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)
Language of assessment: German or English

Allocation of places:
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Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
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**Contents**

The internship is carried out in a non-university research / diagnostic institution or in a company. The contents of the internship will be determined by the institution. The content requirements shall correspond to an internship offered in the study program of the Biochemistry Master program at the University of Würzburg, what has to be defined in advance in consultation with the module coordinator.

**Intended learning outcomes**

Students are acquainted with the structures of non-university institutions and possess specific professional skills.

**Courses** *(type, number of weekly contact hours, language — if other than German)*

No courses assigned to module

**Method of assessment** *(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)*

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

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**Contents**

The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

**Intended learning outcomes**

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses**

(type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Practical lab course 2 | 08-MBC-LP2-152-m01

Module coordinator | Module offered by
chairperson of examination committee Biochemie (Biochemistry) | Chair of Biochemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
15 | (not) successfully completed | --

Duration | Module level | Other prerequisites
---|---|---
| graduate | -- |

Contents
The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

Intended learning outcomes
After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

Courses
No courses assigned to module

Method of assessment
(a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
--
### Module title
Practical lab course 3

### Abbreviation
08-MBC-LP3-152-m01

### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
10

### Method of grading
Only after successfully completed

### Duration
Module level
Other prerequisites

- graduate
- --

### Contents
The lab course is carried out in a working group with biochemical and/or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and/or bioinformatics research methods. The experiments and their results are documented in a written protocol.

### Intended learning outcomes
After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

### Courses
No courses assigned to module

### Method of assessment
a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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Module title | Abbreviation
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Practical lab course 4 | 08-MBC-LP4-152-m01

Module coordinator | Module offered by
chairperson of examination committee Biochemie (Biochemistry) | Chair of Biochemistry

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Intended learning outcomes

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

Courses (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

Allocation of places

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Additional information

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**Intended learning outcomes**

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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### Intended learning outcomes

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

### Courses

No courses assigned to module

### Method of assessment

- a) log (approx. 20 pages) or
- b) oral examination of one candidate each (approx. 20 minutes) or
- c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or
- d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

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**Module coordinator**

Chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**

Chair of Biochemistry

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**Duration**

1 semester

**Module level**

Graduate

**Other prerequisites**

--

**Contents**

The module offers the opportunity to learn correct presenting and mediating scientific questions by giving a tutorial attendant to a lecture at the faculty of chemistry and pharmacy.

**Intended learning outcomes**

The students are able to adequately prepare and present scientific questions, and to guide students in lower semesters.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising study groups: assessment to be successfully completed (type and length of assessment to be specified at the beginning of the course)

Language of assessment: German or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO** (examination regulations for teaching-degree programmes)

--
### Module Contents

The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

### Intended learning outcomes

The student is able to train and to supervise undergraduate students in basic experimental procedures.

### Courses

No courses assigned to module

### Method of assessment

Preparing and supervising student lab courses: assessment to be successfully completed (type and length of assessment to be specified at the beginning of the course)

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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Subfield Completive Qualifications
(10 ECTS credits)
### Module title

Bioorganic Chemistry

### Abbreviation

08-SCM3-152-m01

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### Contents

This module discusses topics at the interface of organic chemistry, biology and medicine. It focuses on molecular interactions and recognition, molecular diversity, active agent development, new aspects of DNA, RNA, proteins and carbohydrates.

### Intended learning outcomes

Students are able to describe molecular interactions and detection mechanisms of bioorganic chemistry. They can explain the molecular diversity of biological systems. They can characterise the fabrication of agents. They can describe modern aspects of DNA, RNA, proteins and carbohydrates.

### Courses

(type, number of weekly contact hours, language — if other than German)

S (3)

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Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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# Module Catalogue for the Subject Biochemistry

**Master's with 1 major, 120 ECTS credits**

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<td>lecturer of seminar &quot;Anorganische Aspekte der Biochemie and Medizinischen Chemie&quot;</td>
<td>Institute of Inorganic Chemistry</td>
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## Contents

This module introduces students to the fundamental principles of bioinorganic chemistry (BIC). It discusses the methods of BIC, structures and effects of metalliferous enzymes and applications of BIC in the fields of diagnosis and therapy.

## Intended learning outcomes

Students are able to describe the principles of, and methods in, BIC. They can explain the structure and effects of metalliferous enzymes and describe applications of BIC in biochemistry and medicine.

## Courses

| Type, number of weekly contact hours, language — if other than German |
|---|---|
| S (3) | |

## Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

## Allocation of places

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## Additional information

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## Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<td>lecturer of the seminar</td>
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### Contents

This module discusses advanced topics in natural product chemistry and biological chemistry.

### Intended learning outcomes

Students are able to discuss advanced topics in natural product chemistry and biological chemistry.

### Courses

(type, number of weekly contact hours, language — if other than German)

S (3)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places

Biochemie (Biochemistry), Master's: 20 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title: Organo- and Biocatalysis

Abbreviation: 08-HKM1-152-m01

Module coordinator: Lecturer of the seminar "Organo- and Biocatalyse"
Module offered by: Faculty of Chemistry and Pharmacy

ECTS: 5
Method of grading: Numerical grade

Duration: 1 semester
Module level: Graduate
Other prerequisites: --

Contents:
This module provides students with deeper insights into topics in organic compounds and enzymes in catalytic processes. Organocatalysis: enantioselective implementation, principles, green chemistry, substance classes and application areas. Biocatalysis: effects of enzymes in view of different aspects, especially regarding organic synthesis.

Intended learning outcomes:
Students are able to categorise organocatalysts and explain their effects and areas of application. They can describe the structure and applications of enzymes in organic synthesis. They are able to mechanistically describe and analyse the effects of enzymes.

Courses:
S (3)

Method of assessment:
(a) written examination (approx. 45 to 90 minutes) or (b) oral examination of one candidate each (20 to 30 minutes) or (c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)
Language of assessment: German and/or English

Allocation of places:
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Additional information:
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**Module coordinator**

holder of the Chair of Bioinformatics

**Module offered by**

Faculty of Biology

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** |
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**Duration** | **Module level** | **Other prerequisites** |
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

**Contents**

Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e.g. net generation sequences, proteomics data), analysis of different functional RNAs (e.g. miRNAs, lncRNAs).

**Intended learning outcomes**

Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + S (1)

Module taught in: German and/or English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
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<td>Systems Biology</td>
<td>07-MS3S-152-m01</td>
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</table>

**Module coordinator**
holder of the Chair of Bioinformatics  
**Module offered by**
Faculty of Biology

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)**
---|---|---
10 | numerical grade | --

**Duration** | **Module level** | **Other prerequisites**
---|---|---
1 semester | graduate | --

**Contents**
Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.

**Intended learning outcomes**
Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.

**Courses**
(V (2) + S (1))
Module taught in: German and/or English

**Method of assessment**
Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)
Language of assessment: German and/or English

**Allocation of places**
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**Additional information**
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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
## Module title
Methods in Life Sciences

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>07-MLS1-152-m01</th>
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## Module coordinator

degree programme coordinator Biologie (Biology)

## Module offered by

Faculty of Biology

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<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</tbody>
</table>

## Contents

Versioned molecular techniques, lipid research methods, microscopic methods, immunohistochemistry, mouse models and gene-knockout approaches, protein and molecular biology techniques, PCR, advanced protein biochemistry, methods in bioinformatics and computational biology.

## Intended learning outcomes

Students are able to review and expand their knowledge of standard molecular techniques and are able to choose methods and techniques to design experiments in a specific research area.

## Courses

(type, number of weekly contact hours, language — if other than German)

<table>
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<tr>
<th>V (3)</th>
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</table>

Module taught in: English

## Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: English

## Allocation of places

--

## Additional information

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## Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
### Module title
Animal science and welfare

### Abbreviation
03-VTK-152-m01

### Module coordinator
Animal Welfare Officer of the University of Würzburg

### Module offered by
Faculty of Medicine

### ECTS
3
### Method of grading
Only after succ. compl. of module(s)

### (not) successfully completed
--

### Duration
1 semester
### Module level
undergraduate
### Other prerequisites
Regular attendance of practical course (as specified at the beginning of the course).

### Contents
Theoretical and practical basic knowledge of animal welfare legislation, animal welfare ethics and laboratory animal science.

### Intended learning outcomes
Students have the expertise to carry out or participate in animal experiments according to the guidelines of FELASA (Cat. B).

### Courses
(type, number of weekly contact hours, language — if other than German)
V (2) + P (1)

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 90 minutes)
Language of assessment: German and/or English

### Allocation of places
--

### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
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## Module title

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<td>Scientific lecturing M₁</td>
<td>08-MBC-WR1-152-m01</td>
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## Module coordinator

- Chairperson of examination committee Biochemie (Biochemistry)
- Chair of Biochemistry

## Method of grading

- Only after successfully completed module(s)

## ECTS

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## Duration

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<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

## Contents

The module offers the opportunity to learn correct presenting and mediating scientific questions by giving a tutorial attendant to a lecture at the faculty of chemistry and pharmacy.

## Intended learning outcomes

The students are able to adequately prepare and present scientific questions, and to guide students in lower semesters.

## Courses

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
<th>Language — if other than German</th>
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<tbody>
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</table>

## Method of assessment

- Preparing and supervising study groups, wrap-up report (approx. 2 pages)
- Language of assessment: German and/or English

## Allocation of places

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## Additional information

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## Referred to in LPO I

- (examination regulations for teaching-degree programmes)
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<td>Chair of Biochemistry</td>
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<td>graduate</td>
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</table>

**Contents**

The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

**Intended learning outcomes**

The student is able to train and to supervise undergraduate students in basic experimental procedures.

**Courses** (type, number of weekly contact hours, language — if other than German)

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<thead>
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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising student lab courses, wrap-up report (approx. 1 page)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
## Literature seminar 3

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<td>Literature seminar 3</td>
<td>08-MBC-LIT3-152-m01</td>
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### Module coordinator

Chairperson of examination committee Biochemie (Biochemistry)

### Chair of Biochemistry

### ECTS

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### Duration

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</table>

### Contents

Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

### Intended learning outcomes

The students train their abilities in reading and critical questioning current literature of the life sciences with relation to the biochemistry. They improve their skills in presenting and arguing of scientific contents.

### Courses

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<tr>
<th>Type</th>
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Module taught in: German or English

### Method of assessment

<table>
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<tbody>
<tr>
<td>presentation (20 to 40 minutes)</td>
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<td>Language of assessment: German and/or English</td>
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### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Focus - Expert Key Qualifications
(40 ECTS credits)
Subfield Research oriented Projects
(20 ECTS credits)
## Module Catalogue for the Subject
### Biochemistry
Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Practical course - abroad 1</td>
<td>08-MBC-AP1-152-m01</td>
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</table>

### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
30

### Duration
Module level: graduate

### Other prerequisites
--

### Contents
The internship is carried out at universities abroad and can be embedded within offered study programs (e.g., Erasmus). The content requirements should comply with those of the electives of the Biochemistry Master program at the University of Würzburg (what has to be ascertained in advance under discussion with the module coordinator).

### Intended learning outcomes
The students are familiar with working methods at universities abroad. Besides professional competences they have also acquired language and social skills.

### Courses
No courses assigned to module

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places
--

### Additional information
--

### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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## Module Catalogue for the Subject
## Biochemistry
### Master’s with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
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<td>Chair of Biochemistry</td>
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### Contents

The internship is carried out at universities abroad and can be embedded within offered study programs (e.g. Erasmus). The content requirements should comply with those of the electives of the Biochemistry Master program at the University of Würzburg (what has to be ascertained in advance under discussion with the module coordinator).

### Intended learning outcomes

The students are familiar with working methods at universities abroad. Besides professional competences they have also acquired language and social skills.

### Courses (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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<table>
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<td>Practical course - external 1</td>
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**Module coordinator**

Chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**

Chair of Biochemistry

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**Duration**

Graduate

**Other prerequisites**

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**Contents**

The internship is carried out in a non-university research / diagnostic institution or in a company. The contents of the internship will be determined by the institution. The content requirements shall correspond to an internship offered in the study program of the Biochemistry Master program at the University of Würzburg, what has to be defined in advance in consultation with the module coordinator.

**Intended learning outcomes**

Students are acquainted with the structures of non-university institutions and possess specific professional skills.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
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### Contents

The internship is carried out in a non-university research / diagnostic institution or in a company. The contents of the internship will be determined by the institution. The content requirements shall correspond to an internship offered in the study program of the Biochemistry Master program at the University of Würzburg, what has to be defined in advance in consultation with the module coordinator.

### Intended learning outcomes

Students are acquainted with the structures of non-university institutions and possess specific professional skills.

### Courses

No courses assigned to module

### Method of assessment

<table>
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<th>(type, scope, language — if other than German)</th>
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<td>a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)</td>
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Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)
### Module title
Practical lab course 1

| Abbreviation | 08-MBC-LP1-152-m01 |

### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
15

### Method of grading
Only after successfully completed

### Duration
Graduate

### Other prerequisites
--

### Contents
The lab course is carried out in a working group with biochemical and/or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and/or bioinformatics research methods. The experiments and their results are documented in a written protocol.

### Intended learning outcomes
After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

### Courses
No courses assigned to module

### Method of assessment
a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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**Module coordinator**
chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**
Chair of Biochemistry

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<tbody>
<tr>
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**Contents**
The lab course is carried out in a working group with biochemical and/or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and/or bioinformatics research methods. The experiments and their results are documented in a written protocol.

**Intended learning outcomes**
After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses**
No courses assigned to module

**Method of assessment**
(a) log (approx. 20 pages) or (b) oral examination of one candidate each (approx. 20 minutes) or (c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or (d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**
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**Additional information**
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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
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**Contents**

The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

**Intended learning outcomes**

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

**Intended learning outcomes**

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses**

(type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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## Module Catalogue for the Subject
### Biochemistry
#### Master's with 1 major, 120 ECTS credits

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### Contents

The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

### Intended learning outcomes

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

### Courses

No courses assigned to module

### Method of assessment

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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**Contents**

The lab course is carried out in a working group with biochemical and / or molecular biology research orientation at the University of Würzburg. The contents of the lab course have to be defined in advance in consultation with the module responsible. The lab course allows intensive training in biochemistry, molecular biology and / or bioinformatics research methods. The experiments and their results are documented in a written protocol.

**Intended learning outcomes**

After attending the lab course, the student has advanced methodological knowledge. He/She is able to transfer the methods used in this course on other issues and to assess their applicability. He/She masters the scientifically correct documentation and discussion of experimentation and results.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) log (approx. 20 pages) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2: approx. 30 minutes, groups of 3: approx. 40 minutes) or d) presentation/talk (approx. 15 to 30 minutes)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

The module offers the opportunity to learn correct presenting and mediating scientific questions by giving a tutorial attendant to a lecture at the faculty of chemistry and pharmacy.

**Intended learning outcomes**

The students are able to adequately prepare and present scientific questions, and to guide students in lower semesters.

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising study groups: assessment to be successfully completed (type and length of assessment to be specified at the beginning of the course)
Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

**Intended learning outcomes**

The student is able to train and to supervise undergraduate students in basic experimental procedures.

**Courses**

(type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising student lab courses: assessment to be successfully completed (type and length of assessment to be specified at the beginning of the course)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Subfield Completive Qualifications
(20 ECTS credits)
### Module title
Bioorganic Chemistry

### Abbreviation
08-SCM3-152-m01

### Module coordinator
lecturer of lecture "Bioorganische Chemie" (Bioorganic Chemistry)

### Module offered by
Institute of Organic Chemistry

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
This module discusses topics at the interface of organic chemistry, biology and medicine. It focuses on molecular interactions and recognition, molecular diversity, active agent development, new aspects of DNA, RNA, proteins and carbohydrates.

### Intended learning outcomes
Students are able to describe molecular interactions and detection mechanisms of bioorganic chemistry. They can explain the molecular diversity of biological systems. They can characterise the fabrication of agents. They can describe modern aspects of DNA, RNA, proteins and carbohydrates.

### Courses
(type, number of weekly contact hours, language — if other than German)

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### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
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Module title | Abbreviation
--- | ---
Bioanorganic Chemistry | 08-ACM2-152-m01

Module coordinator | Module offered by
lecturer of seminar "Anorganische Aspekte der Biochemie and Medizinischen Chemie" (Inorganic Aspects of Biochemistry and Medicinal Chemistry) | Institute of Inorganic Chemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | graduate | --

Contents
This module introduces students to the fundamental principles of bioinorganic chemistry (BIC). It discusses the methods of BIC, structures and effects of metalliferous enzymes and applications of BIC in the fields of diagnosis and therapy.

Intended learning outcomes
Students are able to describe the principles of, and methods in, BIC. They can explain the structure and effects of metalliferous enzymes and describe applications of BIC in biochemistry and medicine.

Courses (type, number of weekly contact hours, language — if other than German)
S (3)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)
Language of assessment: German and/or English

Allocation of places
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Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
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**Module title**  
Modern aspects of natural product Chemistry and Biological Chemistry

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**Module coordinator**  
I lecturer of the seminar

**Module offered by**  
Institute of Organic Chemistry

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**Duration**  
1 semester

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**Contents**  
This module discusses advanced topics in natural product chemistry and biological chemistry.

**Intended learning outcomes**  
Students are able to discuss advanced topics in natural product chemistry and biological chemistry.

**Courses**  
(type, number of weekly contact hours, language — if other than German)

S (3)

**Method of assessment**  
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

**Allocation of places**  
Biochemie (Biochemistry), Master's: 20 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**  
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**Referred to in LPO I**  
(examination regulations for teaching-degree programmes)

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**Contents**

This module provides students with deeper insights into topics in organic compounds and enzymes in catalytic processes. Organocatalysis: enantioselective implementation, principles, green chemistry, substance classes and application areas. Biocatalysis: effects of enzymes in view of different aspects, especially regarding organic synthesis.

**Intended learning outcomes**

Students are able to categorise organocatalysts and explain their effects and areas of application. They can describe the structure and applications of enzymes in organic synthesis. They are able to mechanistically describe and analyse the effects of enzymes.

**Courses** (type, number of weekly contact hours, language — if other than German)

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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
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Human genetics | 03-MS2HG-152-m01

Module coordinator | Module offered by
holder of the Chair of of Human Genetics | Faculty of Medicine

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Contents
This module will discuss current topics in human genetics.

Intended learning outcomes
Students have developed the ability to understand relevant questions in human genetics and to discuss these in detail.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + S (2)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)
Language of assessment: German and/or English

Allocation of places
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Additional information
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**Contents**

Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e.g. net generation sequences, proteomics data), analysis of different functional RNAs (e.g. miRNAs, lncRNAs).

**Intended learning outcomes**

Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + S (1)
Module taught in: German and/or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Module Catalogue for the Subject Biochemistry

#### Master's with 1 major, 120 ECTS credits

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</table>

### Contents

Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.

### Intended learning outcomes

Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.

### Courses

**(type, number of weekly contact hours, language — if other than German)**

- V (2) + S (1)
- Module taught in: German and/or English

### Method of assessment

**(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)**

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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### Module title

**Methods in Life Sciences**

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<th>Abbreviation</th>
<th>07-MLS1-152-m01</th>
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### Module coordinator

degree programme coordinator Biologie (Biology)

### Module offered by

Faculty of Biology

### ECTS

<table>
<thead>
<tr>
<th>10</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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### Duration

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>graduate</td>
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</tr>
</tbody>
</table>

### Contents

Versioned molecular techniques, lipid research methods, microscopic methods, immunohistochemistry, mouse models and gene-knockout approaches, protein and molecular biology techniques, PCR, advanced protein biochemistry, methods in bioinformatics and computational biology.

### Intended learning outcomes

Students are able to review and expand their knowledge of standard molecular techniques and are able to choose methods and techniques to design experiments in a specific research area.

### Courses

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
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</thead>
<tbody>
<tr>
<td>V (3)</td>
</tr>
</tbody>
</table>

Module taught in: English

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Animal science and welfare</td>
<td>03-VTK-152-m01</td>
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</tbody>
</table>

**Module coordinator**  
Animal Welfare Officer of the University of Würzburg

**Module offered by**  
Faculty of Medicine

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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Regular attendance of practical course (as specified at the beginning of the course).</td>
</tr>
</tbody>
</table>

**Contents**

Theoretical and practical basic knowledge of animal welfare legislation, animal welfare ethics and laboratory animal science.

**Intended learning outcomes**

Students have the expertise to carry out or participate in animal experiments according to the guidelines of FELASA (Cat. B).

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + P (1)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
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<td>Scientific lecturing M₁</td>
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<th>Module offered by</th>
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<tbody>
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<td>chairperson of examination committee Biochemie (Biochemistry)</td>
<td>Chair of Biochemistry</td>
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<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</tbody>
</table>

**Contents**

The module offers the opportunity to learn correct presenting and mediating scientific questions by giving a tutorial attendant to a lecture at the faculty of chemistry and pharmacy.

**Intended learning outcomes**

The students are able to adequately prepare and present scientific questions, and to guide students in lower semesters.

**Courses**

(type, number of weekly contact hours, language — if other than German)

T (0)

**Method of assessment**

(type, scope, language — if other than German, examination offered — If not every semester, information on whether module is creditable for bonus)

Preparing and supervising study groups, wrap-up report (approx. 2 pages)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
### Module Catalogue for the Subject

**Biochemistry**

**Master's with 1 major, 120 ECTS credits**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Assistance in practical courses 1</td>
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<table>
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<th>Other prerequisites</th>
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</tbody>
</table>

### Contents

The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

### Intended learning outcomes

The student is able to train and to supervise undergraduate students in basic experimental procedures.

### Courses

<table>
<thead>
<tr>
<th>Type, number of weekly contact hours, language — if other than German</th>
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### Method of assessment

<table>
<thead>
<tr>
<th>Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparing and supervising student lab courses, wrap-up report (approx. 1 page) Language of assessment: German and/or English</td>
</tr>
</tbody>
</table>

### Allocation of places

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### Additional information

--

### Referred to in LPO I (examination regulations for teaching-degree programmes)

--
## Literature seminar 3

**Module title**  
Literature seminar 3

**Abbreviation**  
08-MBC-LIT3-152-m01

<table>
<thead>
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<tbody>
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</table>

**Duration**  
1 semester

**Module level**  
graduate

**Module coordinator**  
Chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**  
Chair of Biochemistry

**Contents**  
Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

**Intended learning outcomes**  
The students train their abilities in reading and critical questioning current literature of the life sciences with relation to biochemistry. They improve their skills in presenting and arguing of scientific contents.

**Courses**  
(type, number of weekly contact hours, language — if other than German)

S (2)  
Module taught in: German or English

**Method of assessment**  
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Presentation (20 to 40 minutes)  
Language of assessment: German and/or English

**Allocation of places**  
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**Additional information**  
--

**Referred to in LPO 1**  
(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Tumor Genetics</td>
<td>03-MBC-TG-161-m01</td>
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<table>
<thead>
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<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>holder of the Professorship Human Genetics</td>
<td>Institute of Human Genetics</td>
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<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
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</tbody>
</table>

**Contents**
Basics on human genetics (inheritance patterns, mutation types, etc.), hereditary cancer (breast & ovarian cancer, HNPCC, FAP, etc.), cancer syndromes, tumor cytogenetics, epigenetics in cancer, animal models in cancer genetics, genetic techniques (NGS, genome engineering, etc.)

**Intended learning outcomes**
The students have acquired broad knowledge in the field of tumor genetics and hereditary tumor diseases as well as specific knowledge about genetic methods. They are able to apply this acquired knowledge to scientific questions in tumor genetics. Students can independently develop scientific texts, discuss them critically and present them.

**Courses**
(V (1) + S (1))
Module taught in: English

**Method of assessment**
(a) written examination (approx. 45 to 90 minutes) or (b) log (20 to 30 pages) or (c) oral examination of one candidate each (20 to 30 minutes) or (d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or (e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
--
Focus - Expert Key Qualifications (project oriented)
(40 ECTS credits)
Subfield Project attendant Modules

(30 ECTS credits)
**Module title**
Special lectures 1

**Abbreviation**
08-MBC-FTSV1-152-m01

**Module coordinator**
Chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**
Chair of Biochemistry

**ECTS**
5

**Method of grading**
Only after succ. compl. of module(s)

**Duration**
1 semester

**Module level**
Graduate

**Other prerequisites**
Please consult with degree programme coordinator in advance.

**Contents**
The module allows participation in a lecture with a thematic scope and relation to the selected major field of study. This lecture provides a special subject-related expansion of scientific knowledge. The lecture may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

**Intended learning outcomes**
The student has improved scientific knowledge, which contributes to the sharpening of specific qualifications. In particular, he/she gained additional expertise that contributes to individual specialization.

**Courses**
(type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: German or English

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)

--
### Module title
Special lectures 2

### Abbreviation
08-MBC-FTSV2-152-m01

### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
5

### Method of grading
Only after successfully completed

### Duration
1 semester

### Module level
Graduate

### Other prerequisites
Please consult with degree programme coordinator in advance.

### Contents
The module allows participation in a lecture with a thematic scope and relation to the selected major field of study. This lecture provides a special subject-related expansion of scientific knowledge. The lecture may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes
The student has improved scientific knowledge, which contributes to the sharpening of specific qualifications. In particular, he/she gained additional expertise that contributes to individual specialization.

### Courses
(V (2))
Module taught in: German or English

### Method of assessment
(a) written examination (approx. 45 to 90 minutes) or (b) log (20 to 30 pages) or (c) oral examination of one candidate each (20 to 30 minutes) or (d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or (e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

### Allocation of places
--

### Additional information
--

### Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
## Module Catalogue for the Subject Biochemistry

### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Conference participation with poster presentation 1</td>
<td>08-MBC-FTKP1-152-m01</td>
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<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
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<tbody>
<tr>
<td>chairperson of examination committee Biochemie (Biochemistry)</td>
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<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Please consult with degree programme coordinator in advance.</td>
</tr>
</tbody>
</table>

### Contents

The module allows participation in a national or international congress with a thematic scope and relation to the selected major field of study, combined with the presentation of own scientific data in a poster session. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student gains a widened overview of the latest findings and developments in the field. He/She has the possibility to meet other scientists in his/her specialism. He/She trains his/her skills, to critically scrutinise the own work, to present it to a professional audience and to defend it against criticism.

### Courses (type, number of weekly contact hours, language — if other than German)

R (0)

Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Poster (1 page)

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I (examination regulations for teaching-degree programmes)

--
### Module title
Conference participation with poster presentation 2

### Abbreviation
08-MBC-FTKP2-152-m01

### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
5

### Method of grading
(not) successfully completed

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
Please consult with degree programme coordinator in advance.

### Contents
The module allows participation in a national or international congress with a thematic scope and relation to the selected major field of study, combined with the presentation of own scientific data in a poster session. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes
The student gains a widened overview of the latest findings and developments in the field. He/She has the possibility to meet other scientists in his/her specialism. He/She trains his/her skills, to critically scrutinise the own work, to present it to a professional audience and to defend it against criticism.

### Courses
(type, number of weekly contact hours, language — if other than German)

R (0)
Module taught in: German or English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Poster (1 page)
Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
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<th>Module level</th>
<th>Other prerequisites</th>
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
<td>Please consult with degree programme coordinator in advance.</td>
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</table>

**Contents**

The module allows participation in a national or international congress with a thematic scope and relation to the selected major field of study, combined with the presentation of own scientific data in a lecture. Recognition as academic achievement is conducted in an individual assessment by the examination board.

**Intended learning outcomes**

The student gains a widened overview of the latest findings and developments in the field. He/She has the possibility to meet other scientists in his/her specialism. He/She trains his/her skills, to critically scrutinise the own work, to present it to a professional audience and to defend it against criticism.

**Courses** (type, number of weekly contact hours, language — if other than German)

R (0)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation (20 to 40 minutes)
Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
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<td>Conference participation with lecture 2</td>
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</thead>
<tbody>
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<td>graduate</td>
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</table>

**Contents**

The module allows participation in a national or international congress with a thematic scope and relation to the selected major field of study, combined with the presentation of own scientific data in a lecture. Recognition as academic achievement is conducted in an individual assessment by the examination board.

**Intended learning outcomes**

The student gains a widened overview of the latest findings and developments in the field. He/She has the possibility to meet other scientists in his/her specialism. He/She trains his/her skills, to critically scrutinise the own work, to present it to a professional audience and to defend it against criticism.

**Courses** *(type, number of weekly contact hours, language — if other than German)*

R (0)

Module taught in: German or English

**Method of assessment** *(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)*

presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

--
## Module Catalogue for the Subject Biochemistry

### Master's with 1 major, 120 ECTS credits

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Excursion 1</td>
<td>08-MBC-FTEX1-152-m01</td>
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### Module coordinator

chairperson of examination committee Biochemie (Biochemistry)

### Module offered by

Chair of Biochemistry

### ECTS

<table>
<thead>
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<th>Method of grading</th>
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### Duration

<table>
<thead>
<tr>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>graduate</td>
</tr>
</tbody>
</table>

Please consult with degree programme coordinator in advance.

### Contents

The module allows to participate in an excursion with a thematic scope and relation to the selected major field of study. It represents a special subject-related expansion of scientific knowledge. The excursion may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student has improved scientific knowledge, which contributes to the sharpening of specific qualifications. In particular, he/she gained additional expertise that contributes to individual specialization.

### Courses

<table>
<thead>
<tr>
<th>(type, number of weekly contact hours, language — if other than German)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (1) Module taught in: German or English</td>
</tr>
</tbody>
</table>

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Excursion 2 | 08-MBC-FTEX2-152-m01

Module coordinator | Module offered by
chairperson of examination committee Biochemie (Biochemistry) | Chair of Biochemistry

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Duration: 1 semester
Module level: graduate
Other prerequisites: Please consult with degree programme coordinator in advance.

Contents
The module allows to participate in an excursion with a thematic scope and relation to the selected major field of study. It represents a special subject-related expansion of scientific knowledge. The excursion may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

Intended learning outcomes
The student has improved scientific knowledge, which contributes to the sharpening of specific qualifications. In particular, he/she gained additional expertise that contributes to individual specialization.

Courses
(type, number of weekly contact hours, language — if other than German)

E (1)
Module taught in: German or English

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places
--

Additional information
--

Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
Module title | Abbreviation
--- | ---
Seminar 1 | 08-MBC-FTSE1-152-m01

Module coordinator | Module offered by
--- | ---
chairperson of examination committee Biochemie (Biochemistry) | Chair of Biochemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | (not) successfully completed | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | graduate | Please consult with degree programme coordinator in advance.

Contents
The module allows participation in a seminar with a thematic scope and relation to the selected major field of study. This seminar provides a deepening and intensification of the subject-specific knowledge. The seminar may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

Intended learning outcomes
The student gains a widened overview of the latest findings and developments in the field. In particular, He/She thereby gained additional expertise that contributes to the individual specialization.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
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**Contents**

The module allows participation in a seminar with a thematic scope and relation to the selected major field of study. This seminar provides a deepening and intensification of the subject-specific knowledge. The seminar may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

**Intended learning outcomes**

The student gains a widened overview of the latest findings and developments in the field. In particular, He/She thereby gained additional expertise that contributes to the individual specialization.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
### Module Catalogue for the Subject Biochemistry

#### Master's with 1 major, 120 ECTS credits

<table>
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### Contents

The module allows participation in a seminar with a thematic scope and relation to the selected major field of study. This seminar provides a deepening and intensification of the subject-specific knowledge. The seminar may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student gains a widened overview of the latest findings and developments in the field. In particular, He/She thereby gained additional expertise that contributes to the individual specialization.

### Courses (type, number of weekly contact hours, language — if other than German)

S (2)

Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I (examination regulations for teaching-degree programmes)

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## Workshop 1

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### Contents

The module allows participation in a workshop with a thematic scope and relation to the selected major field of study. This workshop provides a special subject-related expansion of scientific knowledge and methodological skills. The workshop may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student has improved scientific knowledge and methodological skills, which contribute to the deepening of his/her specific qualifications. In particular, He/She thereby gained additional skills, that contribute to the individual specialization.

### Courses

**R (0)**
Module taught in: German or English

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<th><strong>Scope</strong></th>
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<tr>
<td>Wrap-up report (approx. 2 pages)</td>
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### Allocation of places

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### Additional information

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**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

--
### Module Catalogue for the Subject Biochemistry

#### Master's with 1 major, 120 ECTS credits

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<th>Module title</th>
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### Contents

The module allows participation in a workshop with a thematic scope and relation to the selected major field of study. This workshop provides a special subject-related expansion of scientific knowledge and methodological skills. The workshop may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student has improved scientific knowledge and methodological skills, which contribute to the deepening of his/her specific qualifications. In particular, he/she thereby gained additional skills, that contribute to the individual specialization.

### Courses

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### Method of assessment

Wrap-up report (approx. 2 pages)
Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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Module title | Abbreviation
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Workshop 3 | 08-MBC-FTWS3-152-m01

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### Contents

The module allows participation in a workshop with a thematic scope and relation to the selected major field of study. This workshop provides a special subject-related expansion of scientific knowledge and methodological skills. The workshop may be offered internally or externally of the University of Würzburg. Recognition as academic achievement is conducted in an individual assessment by the examination board.

### Intended learning outcomes

The student has improved scientific knowledge and methodological skills, which contribute to the deepening of his/her specific qualifications. In particular, He/She thereby gained additional skills, that contribute to the individual specialization.

### Courses

(type, number of weekly contact hours, language — if other than German)

**R (0)**
Module taught in: German or English

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

**Wrap-up report (approx. 2 pages)**
Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
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<td>Assistance in practical courses 1</td>
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### Module coordinator
Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

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<tbody>
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<td>1 semester</td>
<td>graduate</td>
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</table>

### Contents
The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

### Intended learning outcomes
The student is able to train and to supervise undergraduate students in basic experimental procedures.

### Courses
(T (o))
Module taught in: German or English

### Method of assessment
Preparing and supervising student lab courses, wrap-up report (approx. 1 page)
Language of assessment: German and/or English

### Allocation of places
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### Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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</table>

### Contents
The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

### Intended learning outcomes
The student is able to train and to supervise undergraduate students in basic experimental procedures.

### Courses (type, number of weekly contact hours, language — if other than German)
T (0)

### Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
Preparing and supervising student lab courses, wrap-up report (approx. 1 page)
Language of assessment: German and/or English

### Allocation of places
--

### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
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Subfield Completive Qualifications
(10 ECTS credits)
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<td>Bioorganic Chemistry</td>
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<th>Module offered by</th>
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<td>lecturer of lecture &quot;Bioorganische Chemie&quot; (Bioorganic Chemistry)</td>
<td>Institute of Organic Chemistry</td>
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<tbody>
<tr>
<td>1 semester</td>
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</tbody>
</table>

### Contents

This module discusses topics at the interface of organic chemistry, biology and medicine. It focuses on molecular interactions and recognition, molecular diversity, active agent development, new aspects of DNA, RNA, proteins and carbohydrates.

### Intended learning outcomes

Students are able to describe molecular interactions and detection mechanisms of bioorganic chemistry. They can explain the molecular diversity of biological systems. They can characterise the fabrication of agents. They can describe modern aspects of DNA, RNA, proteins and carbohydrates.

### Courses

(type, number of weekly contact hours, language — if other than German)

| S (3) |

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
## Module Catalogue for the Subject Biochemistry

### Master's with 1 major, 120 ECTS credits

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<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Bioanorganic Chemistry</td>
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<td>lecturer of seminar &quot;Anorganische Aspekte der Biochemie and Medizinischen Chemie&quot; (Inorganic Aspects of Biochemistry and Medicinal Chemistry)</td>
<td>Institute of Inorganic Chemistry</td>
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<tbody>
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### Contents

This module introduces students to the fundamental principles of bioinorganic chemistry (BIC). It discusses the methods of BIC, structures and effects of metalliferous enzymes and applications of BIC in the fields of diagnosis and therapy.

### Intended learning outcomes

Students are able to describe the principles of, and methods in, BIC. They can explain the structure and effects of metalliferous enzymes and describe applications of BIC in biochemistry and medicine.

### Courses

( type, number of weekly contact hours, language — if other than German)

<table>
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### Method of assessment

( type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- a) written examination (approx. 45 to 90 minutes)
- b) oral examination of one candidate each (20 to 30 minutes)
- c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
<thead>
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</table>

**Contents**
This module discusses advanced topics in natural product chemistry and biological chemistry.

**Intended learning outcomes**
Students are able to discuss advanced topics in natural product chemistry and biological chemistry.

**Courses** (type, number of weekly contact hours, language — if other than German)
S (3)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)
Language of assessment: German and/or English

**Allocation of places**
Biochemie (Biochemistry), Master’s: 20 places. Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.

**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
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### Module Catalogue for the Subject Biochemistry

#### Master's with 1 major, 120 ECTS credits

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<th><strong>Module title</strong></th>
<th><strong>Abbreviation</strong></th>
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<tr>
<td>Organo- and Biocatalysis</td>
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<tbody>
<tr>
<td>lecturer of the seminar &quot;Organo- and Biokatalyse&quot;</td>
<td>Faculty of Chemistry and Pharmacy</td>
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#### Contents

This module provides students with deeper insights into topics in organic compounds and enzymes in catalytic processes. Organo-catalysis: enantioselective implementation, principles, green chemistry, substance classes and application areas. Biocatalysis: effects of enzymes in view of different aspects, especially regarding organic synthesis.

#### Intended learning outcomes

Students are able to categorise organocatalysts and explain their effects and areas of application. They can describe the structure and applications of enzymes in organic synthesis. They are able to mechanistically describe and analyse the effects of enzymes.

#### Courses

(type, number of weekly contact hours, language — if other than German)

S (3)

#### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate)

Language of assessment: German and/or English

#### Allocation of places

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#### Additional information

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#### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
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<td>Bioinformatics</td>
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<td>holder of the Chair of Bioinformatics</td>
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**Contents**

Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e.g. net generation sequences, proteomics data), analysis of different functional RNAs (e.g. miRNAs, IncRNAs).

**Intended learning outcomes**

Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + S (1)

Module taught in: German and/or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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</table>

**Contents**

Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.

**Intended learning outcomes**

Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + S (1)
Module taught in: German and/or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<td>degree programme coordinator Biologie (Biology)</td>
<td>Faculty of Biology</td>
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<td>1 semester</td>
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</table>

**Contents**

Versioned molecular techniques, lipid research methods, microscopic methods, immunohistochemistry, mouse models and gene-knockout approaches, protein and molecular biology techniques, PCR, advanced protein biochemistry, methods in bioinformatics and computational biology.

**Intended learning outcomes**

Students are able to review and expand their knowledge of standard molecular techniques and are able to choose methods and techniques to design experiments in a specific research area.

**Courses** (type, number of weekly contact hours, language — if other than German)

**V (3)**

Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<tbody>
<tr>
<td>Animal Welfare Officer of the University of Würzburg</td>
<td>Faculty of Medicine</td>
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<td>Regular attendance of practical course (as specified at the beginning of the course).</td>
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</table>

**Contents**

Theoretical and practical basic knowledge of animal welfare legislation, animal welfare ethics and laboratory animal science.

**Intended learning outcomes**

Students have the expertise to carry out or participate in animal experiments according to the guidelines of FELASA (Cat. B).

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + P (1)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Module Catalogue for the Subject Biochemistry

Master's with 1 major, 120 ECTS credits

<table>
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<td>chairperson of examination committee Biochemie (Biochemistry)</td>
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<td>graduate</td>
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### Contents

The module offers the opportunity to learn correct presenting and mediating scientific questions by giving a tutorial attendant to a lecture at the faculty of chemistry and pharmacy.

### Intended learning outcomes

The students are able to adequately prepare and present scientific questions, and to guide students in lower semesters.

### Courses

(type, number of weekly contact hours, language — if other than German)

T (0)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising study groups, wrap-up report (approx. 2 pages)
Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
### Module title

**Assistance in practical courses 1**

### Abbreviation

08-MBC-AWA1-152-m01

### Module coordinator

Chairperson of examination committee Biochemie (Biochemistry)

### Module offered by

Chair of Biochemistry

### ECTS

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### Duration

1 semester

### Module level

Graduate

### Other prerequisites

--

### Contents

The module offers the possibility to learn the organization, training and responsible leadership of scientific experiments by assisting undergraduate students in a practical course.

### Intended learning outcomes

The student is able to train and to supervise undergraduate students in basic experimental procedures.

### Courses (type, number of weekly contact hours, language — if other than German)

T (0)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Preparing and supervising student lab courses, wrap-up report (approx. 1 page)

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I (examination regulations for teaching-degree programmes)

--
**Module title**  
Literature seminar 3

**Abbreviation**  
08-MBC-LIT3-152-m01

**Module coordinator**  
chairperson of examination committee Biochemie (Biochemistry)

**Module offered by**  
Chair of Biochemistry

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)**
---|---|---
5 | numerical grade | --

**Duration** | **Module level** | **Other prerequisites**
---|---|---
1 semester | graduate | --

**Contents**

Participants of the module read predetermined papers from a specific subject area of life sciences related to biochemistry. In a rotation mode each participant presents these publications in plenary sessions, followed by a critical discussion of the content presented. The suitability (regarding subject and level) of a given literature seminar has to be clarified with the module coordinator in advance.

**Intended learning outcomes**

The students train their abilities in reading and critical questioning current literature of the life sciences with relation to the biochemistry. They improve their skills in presenting and arguing of scientific contents.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)  
Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation (20 to 40 minutes)  
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Thesis Area
(30 ECTS credits)
## Module title
Final Colloquium

## Abbreviation
08-MBC-KOLL-152-m01

### Module coordinator
chairperson of examination committee Biochemie (Biochemistry)

### Module offered by
Chair of Biochemistry

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
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### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

## Contents
In the Defense the student is presenting the results of her / his Master-Thesis and is defending them in a subsequent critical discussion.

## Intended learning outcomes
The student is able to present the results of his/her Thesis. He/She can defend the choice of the experimental approaches used, the results as well as their evaluation and interpretation in a scientific discussion.

## Courses
(type, number of weekly contact hours, language — if other than German)

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### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

final colloquium (approx. 45 minutes)
Language of assessment: German and/or English

## Allocation of places
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## Additional information
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## Referred to in LPO I
(examination regulations for teaching-degree programmes)
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**Contents**

The module enables the processing of a defined problem within a specified period by applying the scientific methods learned in the course of study.

**Intended learning outcomes**

The student can familiarize oneself on the basis of scientific literature with the current state of research on a given topic. He/She has the ability to process a defined problem / issue using scientific methods and to document the results, to analyse and to interpret them, and to integrate them into the context of the literature in a written thesis.

**Courses**

(type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Master's thesis (approx. 60 pages)
Language of assessment: German or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)

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